

## DETAIL-IN-CONTEXT LENSES FOR INTERACTING WITH OBJECTS IN DIGITAL IMAGE PRESENTATIONS

5 [0001] This application claims priority from Canadian Patent Application Nos. 2,406,047 and 2,406,131 both filed September 30, 2002, the disclosures of which are incorporated herein by reference.

### FIELD OF THE INVENTION

[0002] This invention relates to the field of computer graphics processing, and more specifically, to a method and system for accessing information for interacting with selected objects in digital images using detail-in-context lenses and a detail-in-context graphical user interface ("GUI").

### 10 BACKGROUND OF THE INVENTION

[0003] Modern computer graphics systems, including digital video systems, are used for numerous applications such as electronic shopping, viewing movies and television programmes, and playing computer games. In general, these applications are launched by the computer graphics system's operating system upon selection by a user from a menu or other graphical user interface ("GUI"). A GUI is used to convey information to and receive commands from users and generally includes a variety of GUI objects or controls, including icons, toolbars, drop-down menus, text, dialog boxes, buttons, and the like. A user typically interacts with a GUI by using a pointing device (e.g., a mouse) to position a pointer or cursor over an object and "clicking" on the object.

20 [0004] One problem with these computer graphics systems is their inability to effectively display detailed information for selected graphic objects when those objects are in the context of a larger image. A user may require access to detailed information with respect to an object in order to closely examine the object, to interact with the object, or to interface with an external application or network through the object. For example, the detailed information may be a close-up view of the object. It may also be pricing and delivery information for a product displayed by an electronic shopping application. Or, the detailed information could be a control panel for a character in a computer game.

**[0005]** A similar problem arises upon launch of these applications. The menus displayed to launch applications, which are generally comprised of lists of programs (i.e. in the case of operating systems) and function selections (i.e. in the case of software applications), often obscure or occlude other important information on the user's display screen including data,  
5 desktop icons, and other graphical objects.

**[0006]** While an application may provide "pop-up" windows or "pull-down" menus for a user to access and view detailed information for a selected object in a larger image, in doing so, the relative location of the object in the larger image may be lost to the user. That is, the pop-up window or pull-down menu may obscure a portion of the larger image necessary for effective  
10 interaction with the object. Thus, while the user may have gained access to the detailed information required to interact with the object, the user may lose sight of the context within which that object is positioned in the larger image. This is an example of what is often referred to as the "screen real estate problem".

**[0007]** The screen real estate problem is evident in the interactive electronic shopping system disclosed in United States Patent No. 6,381,583 to Kenney. In Kenney, the interactive electronic shopping system includes: a digital camera to digitize a shopping facility into digital signals representing images of the shopping facility; a central computer data base to store the digital signals; a communication link connected to the central computer data base; a local computer connected to the communication link; and, a control interface connected to the local computer to  
15 enable a shopper to control the local computer such that the local computer obtains data from the central computer data base in response to the digital signals stored therein and displays video images of the shopping facility in response to the obtained data. Detailed information concerning a selected item in the shopping facility is displayed to the user in a pop-up window. Unfortunately, the pop-up window obscures a significant portion of the shopping facility image  
20 and hence the user may lose sight of the context of the selected item in the larger shopping facility image.  
25

**[0008]** The screen real estate problem is also evident in the video game apparatus disclosed in United States Patent No. 6,612,930 to Kawagoe, et al. In Kawagoe, et al., a number of "virtual cameras" are used to provide a user with detailed views about a game character as it moves

through the landscape of the game. Unfortunately, the switching from virtual camera to virtual camera in Kawagoe, et al., neither provides the user with the context of his game character within the larger environment of the game landscape nor improves accessibility to detailed control information for interacting with the game character.

- 5   **[0009]** A need therefore exists for an improved method and system for interacting with selected objects in digital images. Consequently, it is an object of the present invention to obviate or mitigate at least some of the above mentioned disadvantages.

#### SUMMARY OF THE INVENTION

- 10   **[0010]** According to one aspect of the invention, there is provided a method for initiating an electronic shopping transaction for a user-selectable item presented in a computer generated original image on a display, comprising: receiving a selection signal for said item from a user; distorting said original image to produce a distorted region for said item to provide said user with detailed information for said item; and, receiving a purchase signal for said item from said user.

- 15   **[0011]** Preferably, the step of distorting further includes: creating a lens surface for said distorted region; and, transforming said original image by applying a distortion function defining said lens surface to said original image.

**[0012]** Preferably, the step of creating further includes displaying a graphical user interface ("GUI") over said distorted region for adjusting said lens surface.

- 20   **[0013]** Preferably, the lens surface includes a focal region and a base region and said GUI includes: a slide bar icon for adjusting a magnification for said lens surface; a slide bar icon for adjusting a degree of scooping for said lens surface; a bounding rectangle icon with at least one handle icon for adjusting a size and a shape for said focal region; a bounding rectangle icon with at least one handle icon for adjusting a size and a shape for said base region; a move icon for adjusting a location for said lens surface within said original image; a pickup icon for adjusting a  
25   location for said base region within said original image; and, a fold icon for adjusting a location for said focal region relative to said base region.

**[0014]** Preferably, the original image includes a DVD image, a video cassette image, a cable television image, a satellite television image, and a video game image.

**[0015]** Preferably, the selection and purchase signals are generated by moving a cursor on said display with a pointing device.

5 **[0016]** Preferably, the pointing device is a mouse.

**[0017]** Preferably, the distorted region is on said item.

**[0018]** Preferably, the distorted region overlaps said item.

**[0019]** Preferably, the detailed information is said distorted region.

**[0020]** Preferably, the detailed information is purchasing information for said item.

10 **[0021]** Preferably, the purchasing information includes a price, a product identifier, a delivery period, and a function selection icon.

**[0022]** Preferably, the function selection icon includes a purchase icon and an add-to-shopping-cart icon.

**[0023]** Preferably, the purchasing information is presented in a pop-up window.

15 **[0024]** Preferably, the pop-up window is presented adjacent to said distorted region.

**[0025]** According to another aspect of the invention, there is provided a method for initiating a control operation for a user-selectable video game character presented in a computer generated original image on a display, comprising: receiving a selection signal for said character from a user; distorting said original image to produce a distorted region for said character to provide  
20 said user with detailed information for said character; and, receiving a control signal for said character from said user.

**[0026]** According to another aspect of the invention, there is provided a method for emphasizing an advertisement presented in a computer generated original image on a display, comprising:

distorting said original image to produce a distorted region for said advertisement to provide a user with detailed information for said advertisement.

**[0027]** According to another aspect of the invention, there is provided a method for presenting a second GUI over a first GUI on a computer display to avoid occlusion of predetermined elements of said first GUI, comprising: determining whether overlaying said second GUI on said first GUI will occlude said predetermined elements; in response to said determining, distorting said second GUI to produce a distorted GUI having a distorted region avoiding said occlusion of said predetermined elements; and, overlaying said distorted GUI on said first GUI for presentation on said computer display.

**[0028]** Preferably, the step of distorting further includes: creating a lens surface for said distorted region; and, transforming said second GUI by applying a distortion function defining said lens surface to said second GUI.

**[0029]** Preferably, the lens surface is a folded lens surface.

**[0030]** Preferably, the folded lens surface includes a focal region and a base region and said focal region is folded away from said predetermined elements relative to said base region.

**[0031]** Preferably, the step of creating further includes displaying a third GUI over said distorted region for adjusting said lens surface.

**[0032]** Preferably, the third GUI includes: a slide bar icon for adjusting a magnification for said lens surface; a slide bar icon for adjusting a degree of scooping for said lens surface; a bounding rectangle icon with at least one handle icon for adjusting a size and a shape for said focal region; a bounding rectangle icon with at least one handle icon for adjusting a size and a shape for said base region; a move icon for adjusting a location for said lens surface within said second GUI; a pickup icon for adjusting a location for said base region within said second GUI; and, a fold icon for adjusting a location for said focal region relative to said base region.

**[0033]** Preferably, the first GUI is a desktop GUI.

**[0034]** Preferably, the predetermined elements are predetermined icons in said desktop GUI.

**[0035]** Preferably, the first GUI is a menu.

**[0036]** Preferably, the menu includes a pop-up menu and a pull-down menu.

**[0037]** Preferably, the predetermined elements are predetermined items in said menu.

**[0038]** Preferably, the second GUI is a menu.

5 **[0039]** Preferably, the menu includes a pop-up menu and a pull-down menu.

#### **[0040]** BRIEF DESCRIPTION OF THE DRAWINGS

**[0041]** Embodiments of the invention may best be understood by referring to the following description and accompanying drawings. In the description and drawings, like numerals refer to like structures or processes. In the drawings:

10 **[0042]** FIG. 1 is a graphical representation of the geometry for constructing a three-dimensional (3D) perspective viewing frustum, relative to an x, y, z coordinate system, in accordance with known elastic presentation space graphics technology;

**[0043]** FIG. 2 is a graphical representation of the geometry of a presentation in accordance with known elastic presentation space graphics technology;

15 **[0044]** FIG. 3 is a block diagram illustrating a data processing system adapted for implementing an embodiment of the invention;

**[0045]** FIG. 4 is a partial screen capture illustrating a GUI having lens control elements for user interaction with detail-in-context data presentations in accordance with an embodiment of the invention;

20 **[0046]** FIG. 5 is a screen capture illustrating the attachment of a lens to a selected object in an original image to produce a detail-in-context presentation to facilitate electronic shopping in accordance with an embodiment of the invention;

**[0047]** FIG. 6 is a screen capture illustrating the application of lenses in multi-player video games in accordance with an embodiment of the invention;

**[0048]** FIG. 7 is a screen capture illustrating a lens applied to an advertisement in a video game in accordance with an embodiment of the invention;

**[0049]** FIG. 8 is a screen capture illustrating a known operating system GUI having various desktop icons;

5 **[0050]** FIG. 9 is a screen capture illustrating the operating system GUI of FIG. 8 with an overlaid pop-up menu;

**[0051]** FIG. 10 is a screen capture illustrating an operating system GUI presentation in which detail-in-context folding is applied in accordance with an embodiment of the invention;

10 **[0052]** FIG. 11 is a flow chart illustrating a method for initiating an electronic shopping transaction for a user-selectable item presented in a computer generated original image on a display in accordance with an embodiment of the invention; and,

**[0053]** FIG. 12 is a flow chart illustrating a method for presenting a second GUI over a first GUI on a computer display to avoid occlusion of predetermined elements of the first GUI in accordance with an embodiment of the invention.

## 15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0054]** In the following description, numerous specific details are set forth to provide a thorough understanding of the invention. However, it is understood that the invention may be practiced without these specific details. In other instances, well-known software, circuits, structures and techniques have not been described or shown in detail in order not to obscure the invention. The  
20 term “data processing system” is used herein to refer to any machine for processing data, including the computer systems, gaming consoles, and network arrangements described herein.

**[0055]** The “screen real estate problem” mentioned above generally arises whenever large amounts of information are to be displayed on a display screen of limited size. Well-known tools to address this problem include panning and zooming. While these tools are suitable for a large  
25 number of visual display applications, they become less effective where sections of the visual information are spatially related, such as in maps, three-dimensional representations, video

games, and newspapers, for example. In this type of information display, panning and zooming are not as effective as much of the context of the panned or zoomed display may be hidden.

**[0056]** A recent solution to this problem is the application of “detail-in-context” presentation techniques. Detail-in-context is the magnification of a particular region-of-interest (the “focal region” or “detail”) in a data presentation while preserving visibility of the surrounding information (the “context”). This technique has applicability to the display of large surface area media (e.g. digital maps) on computer screens of variable size including graphics workstations, laptop computers, personal digital assistants (“PDAs”), and cell phones.

**[0057]** In the detail-in-context discourse, differentiation is often made between the terms “representation” and “presentation”. A representation is a formal system, or mapping, for specifying raw information or data that is stored in a computer or data processing system. For example, a digital map of a city is a representation of raw data including street names and the relative geographic location of streets and utilities. Such a representation may be displayed visually on a computer screen or printed on paper. On the other hand, a presentation is a spatial organization of a given representation that is appropriate for the task at hand. Thus, a presentation of a representation organizes such things as the point of view and the relative emphasis of different parts or regions of the representation. For example, a digital map of a city may be presented with a region magnified to reveal street names.

**[0058]** In general, a detail-in-context presentation may be considered as a distorted view (or distortion) of a portion of the original representation where the distortion is the result of the application of a “lens” like distortion function to the original representation. A detailed review of various detail-in-context presentation techniques such as “Elastic Presentation Space” (“EPS”) (or “Pliable Display Technology” (“PDT”)) may be found in a publication by Marianne S. T. Carpendale, entitled “A Framework for Elastic Presentation Space” (Carpendale, Marianne S. T., *A Framework for Elastic Presentation Space* (Burnaby, British Columbia: Simon Fraser University, 1999)), and incorporated herein by reference.

**[0059]** In general, detail-in-context data presentations are characterized by magnification of areas of an image where detail is desired, in combination with compression of a restricted range of areas of the remaining information (i.e. the context), the result typically giving the appearance



of a lens having been applied to the display surface. Using the techniques described by Carpendale, points in a representation are displaced in three dimensions and a perspective projection is used to display the points on a two-dimensional presentation display. Thus, when a lens is applied to a two-dimensional continuous surface representation, for example, the resulting presentation appears to be three-dimensional. In other words, the lens transformation appears to have stretched the continuous surface in a third dimension. In EPS graphics technology, a two-dimensional visual representation is placed onto a surface; this surface is placed in three-dimensional space; the surface, containing the representation, is viewed through perspective projection; and the surface is manipulated to effect the reorganization of image details. The presentation transformation is separated into two steps: surface manipulation or distortion and perspective projection.

**[0060]** FIG. 1 is a graphical representation **100** of the geometry for constructing a three-dimensional ("3D") perspective viewing frustum **220**, relative to an x, y, z coordinate system, in accordance with known elastic presentation space (EPS) graphics technology. In EPS technology, detail-in-context views of two-dimensional ("2D") visual representations are created with sight-line aligned distortions of a 2D information presentation surface within a 3D perspective viewing frustum **220**. In EPS, magnification of regions of interest and the accompanying compression of the contextual region to accommodate this change in scale are produced by the movement of regions of the surface towards the viewpoint ("VP") **240** located at the apex of the pyramidal shape **220** containing the frustum. The process of projecting these transformed layouts via a perspective projection results in a new 2D layout which includes the zoomed and compressed regions. The use of the third dimension and perspective distortion to provide magnification in EPS provides a meaningful metaphor for the process of distorting the information presentation surface. The 3D manipulation of the information presentation surface in such a system is an intermediate step in the process of creating a new 2D layout of the information.

**[0061]** FIG. 2 is a graphical representation **200** of the geometry of a presentation in accordance with known EPS graphics technology. EPS graphics technology employs viewer-aligned perspective projections to produce detail-in-context presentations in a reference view plane **201** which may be viewed on a display. Undistorted 2D data points are located in a basal plane **210**

of a 3D perspective viewing volume or frustum **220** which is defined by extreme rays **221** and **222** and the basal plane **210**. The VP **240** is generally located above the centre point of the basal plane **210** and reference view plane ("RVP") **201**. Points in the basal plane **210** are displaced upward onto a distorted surface **230** which is defined by a general 3D distortion function (i.e. a detail-in-context distortion basis function). The direction of the viewer-aligned perspective projection corresponding to the distorted surface **230** is indicated by the line FPo - FP **231** drawn from a point FPo **232** in the basal plane **210** through the point FP **233** which corresponds to the focus or focal region or focal point of the distorted surface **230**.

**[0062]** EPS is applicable to multidimensional data and is well suited to implementation on a computer for dynamic detail-in-context display on an electronic display surface such as a monitor. In the case of two dimensional data, EPS is typically characterized by magnification of areas of an image where detail is desired **233**, in combination with compression of a restricted range of areas of the remaining information (i.e. the context) **234**, the end result typically giving the appearance of a lens **230** having been applied to the display surface. The areas of the lens **230** where compression occurs may be referred to as the "shoulder" **234** of the lens **230**. The area of the representation transformed by the lens may be referred to as the "lensed area". The lensed area thus includes the focal region and the shoulder. To reiterate, the source image or representation to be viewed is located in the basal plane **210**. Magnification **233** and compression **234** are achieved through elevating elements of the source image relative to the basal plane **210**, and then projecting the resultant distorted surface onto the reference view plane **201**. EPS performs detail-in-context presentation of n-dimensional data through the use of a procedure wherein the data is mapped into a region in an (n+1) dimensional space, manipulated through perspective projections in the (n+1) dimensional space, and then finally transformed back into n-dimensional space for presentation. EPS has numerous advantages over conventional zoom, pan, and scroll technologies, including the capability of preserving the visibility of information outside **234** the local region of interest **233**.

**[0063]** For example, and referring to FIGS. 1 and 2, in two dimensions, EPS can be implemented through the projection of an image onto a reference plane **201** in the following manner. The source image or representation is located on a basal plane **210**, and those regions of interest **233** of the image for which magnification is desired are elevated so as to move them closer to a

reference plane situated between the reference viewpoint **240** and the reference view plane **201**. Magnification of the focal region **233** closest to the RVP **201** varies inversely with distance from the RVP **201**. As shown in FIGS. 1 and 2, compression of regions **234** outside the focal region **233** is a function of both distance from the RVP **201**, and the gradient of the function describing the vertical distance from the RVP **201** with respect to horizontal distance from the focal region **233**. The resultant combination of magnification **233** and compression **234** of the image as seen from the reference viewpoint **240** results in a lens-like effect similar to that of a magnifying glass applied to the image. Hence, the various functions used to vary the magnification and compression of the source image via vertical displacement from the basal plane **210** are described as lenses, lens types, or lens functions. Lens functions that describe basic lens types with point and circular focal regions, as well as certain more complex lenses and advanced capabilities such as folding, have previously been described by Carpendale.

**[0064] System.** FIG. 3 is a block diagram of a data processing system **300** adapted to implement an embodiment of the invention. The data processing system is suitable for implementing EPS technology, for displaying detail-in-context presentations of representations, for viewing DVDs, videos, television programmes, and for playing computer games in conjunction with a detail-in-context graphical user interface ("GUI") **400**, as described below. The data processing system **300** includes an input device **310**, a central processing unit or CPU **320**, memory **330**, a display **340**, and a media interface **350**. The input device **310** may include a keyboard, mouse, trackball, remote control, or similar device. The CPU **320** may include dedicated coprocessors and memory devices. The memory **330** may include RAM, ROM, or disk devices. The display **340** may include a computer screen, terminal device, or a hardcopy producing output device such as a printer or plotter. And, the media interface **350** may include a network connection including an Internet connection, a cable television connection, a satellite television connection, a DVD player, a video cassette player, or a gaming console. The data processing system **300** may be a gaming console or multimedia enabled personal computer. The data processing system **300** has stored therein data representing sequences of instructions which when executed cause the method described herein to be performed. Of course, the data processing system **300** may contain additional software and hardware a description of which is not necessary for understanding the invention.

**[0065]** *GUI with Lens Control Elements.* As mentioned, detail-in-context presentations of data using techniques such as pliable surfaces, as described by Carpendale, are useful in presenting large amounts of information on limited-size display surfaces. Detail-in-context views allow magnification of a particular region-of-interest (the “focal region”) **233** in a data presentation while preserving visibility of the surrounding information **210**. In the following, a GUI **400** is described having lens control elements that can be implemented in software and applied to the control of detail-in-context data presentations. The software can be loaded into and run by the data processing system **300** of FIG. 3.

**[0066]** FIG. 4 is a partial screen capture illustrating a GUI **400** having lens control elements for user interaction with detail-in-context data presentations in accordance with an embodiment of the invention. Detail-in-context data presentations are characterized by magnification of areas of an image where detail is desired, in combination with compression of a restricted range of areas of the remaining information (i.e. the context), the end result typically giving the appearance of a lens having been applied to the display screen surface. This lens **410** includes a “focal region” **420** having high magnification, a surrounding “shoulder region” **430** where information is typically visibly compressed, and a “base” **412** surrounding the shoulder region **430** and defining the extent of the lens **410**. In FIG. 4, the lens **410** is shown with a circular shaped base **412** (or outline) and with a focal region **420** lying near the center of the lens **410**. However, the lens **410** and focal region **420** may have any desired shape. For example, in FIG. 5, the lens **410** has a pyramid shape with a flat top **420** and trapezoidal shoulders **430**. As mentioned above, the base of the lens **412** may be coextensive with the focal region **420**.

**[0067]** In general, the GUI **400** has lens control elements that, in combination, provide for the interactive control of the lens **410**. The effective control of the characteristics of the lens **410** by a user (i.e. dynamic interaction with a detail-in-context lens) is advantageous. At any given time, one or more of these lens control elements may be made visible to the user on the display surface **340** by appearing as overlay icons on the lens **410**. Interaction with each element is performed via the motion of an input or pointing device **310** (e.g. mouse), with the motion resulting in an appropriate change in the corresponding lens characteristic. As will be described, selection of which lens control element is actively controlled by the motion of the pointing device **310** at any given time is determined by the proximity of the icon representing the pointing device **310** (e.g.

cursor) on the display surface **340** to the appropriate component of the lens **410**. For example, “dragging” of the pointing device at the periphery of the bounding rectangle of the lens base **412** causes a corresponding change in the size of the lens **410** (i.e. “resizing”). Thus, the GUI **400** provides the user with a visual representation of which lens control element is being adjusted through the display of one or more corresponding icons.

**[0068]** For ease of understanding, the following discussion will be in the context of using a two-dimensional pointing device **310** that is a mouse, but it will be understood that the invention may be practiced with other 2-D or 3-D (or even greater numbers of dimensions) pointing devices including a trackball and keyboard.

**[0069]** A mouse **310** controls the position of a cursor icon **401** that is displayed on the display screen **340**. The cursor **401** is moved by moving the mouse **310** over a flat surface, such as the top of a desk, in the desired direction of movement of the cursor **401**. Thus, the two-dimensional movement of the mouse **310** on the flat surface translates into a corresponding two-dimensional movement of the cursor **401** on the display screen **340**.

**[0070]** A mouse **310** typically has one or more finger actuated control buttons (i.e. mouse buttons). While the mouse buttons can be used for different functions such as selecting a menu option pointed at by the cursor **401**, the disclosed invention may use a single mouse button to “select” a lens **410** and to trace the movement of the cursor **401** along a desired path. Specifically, to select a lens **410**, the cursor **401** is first located within the extent of the lens **410**.

In other words, the cursor **401** is “pointed” at the lens **410**. Next, the mouse button is depressed and released. That is, the mouse button is “clicked”. Selection is thus a point and click operation. To trace the movement of the cursor **401**, the cursor **401** is located at the desired starting location, the mouse button is depressed to signal the computer **320** to activate a lens control element, and the mouse **310** is moved while maintaining the button depressed. After the desired path has been traced, the mouse button is released. This procedure is often referred to as “clicking” and “dragging” (i.e. a click and drag operation). It will be understood that a predetermined key on a keyboard **310** could also be used to activate a mouse click or drag. In the following, the term “clicking” will refer to the depression of a mouse button indicating a

selection by the user and the term “dragging” will refer to the subsequent motion of the mouse 310 and cursor 401 without the release of the mouse button.

5 [0071] The GUI 400 may include the following lens control elements: move, pickup, resize base, resize focus, fold, magnify, and scoop. Each of these lens control elements has at least one lens control icon or alternate cursor icon associated with it. In general, when a lens 410 is selected by a user through a point and click operation, the following lens control icons may be displayed over the lens 410: pickup icon 450, base outline icon 412, base bounding rectangle icon 411, focal region bounding rectangle icon 421, handle icons 481, 482, 491, magnify slide bar icon 440, and scoop slide bar icon 540 (see FIG. 5). Typically, these icons are displayed  
10 simultaneously after selection of the lens 410. In addition, when the cursor 401 is located within the extent of a selected lens 410, an alternate cursor icon 460, 470, 480, 490 may be displayed over the lens 410 to replace the cursor 401 or may be displayed in combination with the cursor 401. These lens control elements, corresponding icons, and their effects on the characteristics of a lens 410 are described below with reference to FIG. 4.

15 [0072] In general, when a lens 410 is selected by a point and click operation, bounding rectangle icons 411, 421 are displayed surrounding the base 412 and focal region 420 of the selected lens 410 to indicate that the lens 410 has been selected. With respect to the bounding rectangles 411, 421 one might view them as glass windows enclosing the lens base 412 and focal region 420, respectively. The bounding rectangles 411, 421 include handle icons 481, 482, 491 allowing for  
20 direct manipulation of the enclosed base 412 and focal region 420 as will be explained below. Thus, the bounding rectangles 411, 421 not only inform the user that the lens 410 has been selected, but also provide the user with indications as to what manipulation operations might be possible for the selected lens 410 through use of the displayed handles 481, 482, 491. Note that it is well within the scope of the present invention to provide a bounding region having a shape  
25 other than generally rectangular. Such a bounding region could be of any of a great number of shapes including oblong, oval, ovoid, conical, cubic, cylindrical, polyhedral, spherical, etc.

[0073] Moreover, the cursor 401 provides a visual cue indicating the nature of an available lens control element. As such, the cursor 401 will generally change in form by simply pointing to a different lens control icon 450, 412, 411, 421, 481, 482, 491, 440, 540. For example, when

resizing the base 412 of a lens 410 using a corner handle 491, the cursor 401 will change form to a resize icon 490 once it is pointed at (i.e. positioned over) the corner handle 491. The cursor 401 will remain in the form of the resize icon 490 until the cursor 401 has been moved away from the corner handle 491.

5   **[0074] Move.** Lateral movement of a lens 410 is provided by the move lens control element of the GUI 400. This functionality is accomplished by the user first selecting the lens 410 through a point and click operation. Then, the user points to a point within the lens 410 that is other than a point lying on a lens control icon 450, 412, 411, 421, 481, 482, 491, 440, 540. When the cursor 401 is so located, a move icon 460 is displayed over the lens 410 to replace the cursor 401 or  
10   may be displayed in combination with the cursor 401. The move icon 460 not only informs the user that the lens 410 may be moved, but also provides the user with indications as to what movement operations are possible for the selected lens 410. For example, the move icon 460 may include arrowheads indicating up, down, left, and right motion. Next, the lens 410 is moved by a click and drag operation in which the user clicks and drags the lens 410 to the desired  
15   position on the screen 340 and then releases the mouse button 310. The lens 410 is locked in its new position until a further pickup and move operation is performed.

**[0075] Pickup.** Lateral movement of a lens 410 is also provided by the pickup lens control element of the GUI. This functionality is accomplished by the user first selecting the lens 410 through a point and click operation. As mentioned above, when the lens 410 is selected a pickup  
20   icon 450 is displayed over the lens 410 at the cursor location (e.g. near the centre of the lens 410). Typically, the pickup icon 450 will be a crosshairs. In addition, a base outline 412 is displayed over the lens 410 representing the base 412 of the lens 410. The crosshairs 450 and lens outline 412 not only inform the user that the lens has been selected, but also provides the user with an indication as to the pickup operation that is possible for the selected lens 410. Next,  
25   the user points at the crosshairs 450 with the cursor 401. Then, the lens outline 412 is moved by a click and drag operation in which the user clicks and drags the crosshairs 450 to the desired position on the screen 340 and then releases the mouse button 310. The full lens 410 is then moved to the new position and is locked there until a further pickup operation is performed. In contrast to the move operation described above, with the pickup operation, it is the outline 412 of  
30   the lens 410 that the user repositions rather than the full lens 410.

[0076] *Resize Base*. Resizing of the base **412** (or outline) of a lens **410** is provided by the resize base lens control element of the GUI. After the lens **410** is selected, a bounding rectangle icon **411** is displayed surrounding the base **412**. The bounding rectangle **411** includes handles **491**. These handles **491** can be used to stretch the base **412** taller or shorter, wider or narrower, or proportionally larger or smaller. The corner handles **491** will keep the proportions the same while changing the size. The middle handles (not shown) will make the base **412** taller or shorter, wider or narrower. Resizing the base **412** by the corner handles **491** will keep the base **412** in proportion. Resizing the base **412** by the middle handles (not shown) will change the proportions of the base **412**. That is, the middle handles (not shown) change the aspect ratio of the base **412** (i.e. the ratio between the height and the width of the bounding rectangle **411** of the base **412**). When a user points at a handle **491** with the cursor **401** a resize icon **490** may be displayed over the handle **491** to replace the cursor **401** or may be displayed in combination with the cursor **401**. The resize icon **490** not only informs the user that the handle **491** may be selected, but also provides the user with indications as to the resizing operations that are possible with the selected handle. For example, the resize icon **490** for a corner handle **491** may include arrows indicating proportional resizing. The resize icon (not shown) for a middle handle (not shown) may include arrows indicating width resizing or height resizing. After pointing at the desired handle **491**, the user would click and drag the handle **491** until the desired shape and size for the base **412** is reached. Once the desired shape and size are reached, the user would release the mouse button **310**. The base **412** of the lens **410** is then locked in its new size and shape until a further base resize operation is performed.

[0077] *Resize Focus*. Resizing of the focal region **420** of a lens **410** is provided by the resize focus lens control element of the GUI. After the lens **410** is selected, a bounding rectangle icon **421** is displayed surrounding the focal region **420**. The bounding rectangle **421** includes handles **481**, **482**. These handles **481**, **482** can be used to stretch the focal region **420** taller or shorter, wider or narrower, or proportionally larger or smaller. The corner handles **481** will keep the proportions the same while changing the size. The middle handles **482** will make the focal region **420** taller or shorter, wider or narrower. Resizing the focal region **420** by the corner handles **481** will keep the focal region **420** in proportion. Resizing the focal region **420** by the middle handles **482** will change the proportions of the focal region **420**. That is, the middle handles **482** change the aspect ratio of the focal region **420** (i.e. the ratio between the height and the width of the



bounding rectangle 421 of the focal region 420). When a user points at a handle 481, 482 with the cursor 401 a resize icon 480 may be displayed over the handle 481, 482 to replace the cursor 401 or may be displayed in combination with the cursor 401. The resize icon 480 not only informs the user that a handle 481, 482 may be selected, but also provides the user with  
5 indications as to the resizing operations that are possible with the selected handle. For example, the resize icon 480 for a corner handle 481 may include arrows indicating proportional resizing. The resize icon 480 for a middle handle 482 may include arrows indicating width resizing or height resizing. After pointing at the desired handle 481, 482, the user would click and drag the handle 481, 482 until the desired shape and size for the focal region 420 is reached. Once the  
10 desired shape and size are reached, the user would release the mouse button 310. The focal region 420 is then locked in its new size and shape until a further focus resize operation is performed.

**[0078] Fold.** Folding of the focal region 420 of a lens 410 is provided by the fold control element of the GUI. In general, control of the degree and direction of folding (i.e. skewing of the  
15 viewer aligned vector 231 as described by Carpendale) is accomplished by a click and drag operation on a point 471, other than a handle 481, 482, on the bounding rectangle 421 surrounding the focal region 420. The direction of folding is determined by the direction in which the point 471 is dragged. The degree of folding is determined by the magnitude of the translation of the cursor 401 during the drag. In general, the direction and degree of folding  
20 corresponds to the relative displacement of the focus 420 with respect to the lens base 410. In other words, and referring to FIG. 2, the direction and degree of folding corresponds to the displacement of the point FP 233 relative to the point FPo 232, where the vector joining the points FPo 232 and FP 233 defines the viewer aligned vector 231. In particular, after the lens 410 is selected, a bounding rectangle icon 421 is displayed surrounding the focal region 420. The  
25 bounding rectangle 421 includes handles 481, 482. When a user points at a point 471, other than a handle 481, 482, on the bounding rectangle 421 surrounding the focal region 420 with the cursor 401, a fold icon 470 may be displayed over the point 471 to replace the cursor 401 or may be displayed in combination with the cursor 401. The fold icon 470 not only informs the user that a point 471 on the bounding rectangle 421 may be selected, but also provides the user with  
30 indications as to what fold operations are possible. For example, the fold icon 470 may include arrowheads indicating up, down, left, and right motion. By choosing a point 471, other than a

handle 481, 482, on the bounding rectangle 421 a user may control the degree and direction of folding. To control the direction of folding, the user would click on the point 471 and drag in the desired direction of folding. To control the degree of folding, the user would drag to a greater or lesser degree in the desired direction of folding. Once the desired direction and degree of folding is reached, the user would release the mouse button 310. The lens 410 is then locked with the selected fold until a further fold operation is performed.

[0079] *Magnify*. Magnification of the lens 410 is provided by the magnify lens control element of the GUI. After the lens 410 is selected, the magnify control is presented to the user as a slide bar icon 440 near or adjacent to the lens 410 and typically to one side of the lens 410. Sliding the bar 441 of the slide bar 440 results in a proportional change in the magnification of the lens 410. The slide bar 440 not only informs the user that magnification of the lens 410 may be selected, but also provides the user with an indication as to what level of magnification is possible. The slide bar 440 includes a bar 441 that may be slid up and down, or left and right, to adjust and indicate the level of magnification. To control the level of magnification, the user would click on the bar 441 of the slide bar 440 and drag in the direction of desired magnification level. Once the desired level of magnification is reached, the user would release the mouse button 310. The lens 410 is then locked with the selected magnification until a further magnification operation is performed. In general, the focal region 420 is an area of the lens 410 having constant magnification (i.e. if the focal region is a plane). Again referring to FIGS. 1 and 2, magnification of the focal region 420, 233 varies inversely with the distance from the focal region 420, 233 to the reference view plane (RVP) 201. Magnification of areas lying in the shoulder region 430 of the lens 410 also varies inversely with their distance from the RVP 201. Thus, magnification of areas lying in the shoulder region 430 will range from unity at the base 412 to the level of magnification of the focal region 420.

[0080] *Scoop*. The concavity or "scoop" of the shoulder region 430 of the lens 410 is provided by the scoop lens control element of the GUI. After the lens 410 is selected, the scoop control is presented to the user as a slide bar icon 540 (see FIG. 5) near or adjacent to the lens 410 and typically below the lens 410. Sliding the bar 541 of the slide bar 540 results in a proportional change in the concavity or scoop of the shoulder region 430 of the lens 410. The slide bar 540 not only informs the user that the shape of the shoulder region 430 of the lens 410 may be

selected, but also provides the user with an indication as to what degree of shaping is possible. The slide bar **540** includes a bar **541** that may be slid left and right, or up and down, to adjust and indicate the degree of scooping. To control the degree of scooping, the user would click on the bar **541** of the slide bar **540** and drag in the direction of desired scooping degree. Once the  
5 desired degree of scooping is reached, the user would release the mouse button **310**. The lens **410** is then locked with the selected scoop until a further scooping operation is performed.

**[0081]** *Icon Hiding.* Advantageously, a user may choose to hide one or more lens control icons **450, 412, 411, 421, 481, 482, 491, 440, 540** shown in FIGS. 4 and 5 from view so as not to impede the user's view of the image within the lens **410**. This may be helpful, for example,  
10 during a move or selection operation. A user may select this option through means such as a menu or lens property dialog box.

**[0082]** *Electronic Shopping with Detail-In-Context Lenses.* Now, in accordance with an embodiment of the present invention, detail-in-context data viewing techniques are applied to digital image presentations in electronic shopping applications. Detail-in-context data viewing  
15 techniques allow a user to view multiple levels of detail or resolution on one display **340**. The appearance of the data display or presentation is that of one or more virtual lens showing detail **233** within the context of a larger area view **210**. As will be described, detail-in-context lenses may be used to facilitate direct interaction with electronic shopping applications. In addition, detail-in-context lenses may act as portals or interfaces to networked and local sources of  
20 information including shopping networks, financial networks, and local information sources.

**[0083]** FIG. 5 is a screen capture illustrating the attachment of a lens **410** to a selected object **510** in an original image to produce a detail-in-context presentation **505** to facilitate electronic shopping in accordance with an embodiment of the invention. In FIG. 5, the selected object **510** is a celebrity's wrist watch and the original image (not shown) is a digital image (e.g. a television  
25 program) displayed within a window **500** on a display screen **340**. Along with the window **500** and detail-in-context presentation **505**, a toolbar icon **501** is presented to the user on the display screen **340**. The toolbar icon **501** includes an activation icon **502** (e. g. "PDT Active") for initiating the attachment of the lens **410** to the selected object **510** and/or for initiating an electronic shopping application.

[0084] When a lens 410 is placed over an area of interest 510, a user can interact with the lens directly either via a pointing device (e.g. a mouse or stylus) or a remote control device (e.g. a television remote control unit, a wireless controlling device including a tablet or handheld computer, etc.) 310. The lens 410 can be activated while the user is viewing a television program to allow the user to view items of interest 510 in much greater detail without having to leave the program to select another application. In addition to viewing the item in greater detail, the user can select and directly interact with the item of interest 510.

[0085] For example, a user watching a television program, DVD, or video can view a watch 510 or other item that a celebrity is wearing, in real-time and with improved detail, without having to switch channels or stop the program. This interaction is an improvement over simply clicking on the watch 510 and having a window pop up showing a static image of the watch. With the lens 410, a user can view the exact item 510 as it appears on screen 340 in real-time. Furthermore, the lens 410 may move in real-time with the item 510 it is associated with.

[0086] Using a remote control device 310, the user can directly control the lens 410 and place it over different items of interest 510 or have the lens scripted to move over different items. Multiple lenses 410 can be used and controlled. In addition, using the lens interface, not only can the item of interest 510 be viewed in greater detail but, detailed information 503 pertaining to the item 510 can be viewed. This detailed information 503 may be presented in a pop-up window adjacent to the lens 410 and may include information such as the brand, model, and price of the selected item 510.

[0087] The detailed information 503 can include mechanisms (e.g. icons, application interfaces, etc.) for initiating a direct electronic purchase or for the placing of a link to the item 510 in an electronic "shopping cart" for subsequent purchase. The lens 410 or detailed information 503 can also interface with stored user profiles. These profiles, which store information about the user (e.g. account number, payment method preference, delivery address, etc.), can be read by the lens interface for submission to an external electronic shopping application or network to identify and authenticate the user. The external electronic shopping network may be an Internet based network known to those skilled in the art.

**[0088]** The detailed information **503** for selected objects **510** may be stored in the DVD, video, television program, and/or in a database stored in the computer's memory **330**. The detailed information **503** is linked to objects **510** presented to users via the display screen **340** by known methods. For example, spatial coordinates for objects **510** in the presentation **505** may be associated with the corresponding detailed information **503** in the DVD or database **330**. This association may be made manually by an editor when the DVD, video, or television program product is created.

**[0089]** For example, the present invention may be used in conjunction with Windows XP Media Center™ for: detail-in-context viewing of television programs; interaction with live television programs; encouraging purchases within television programs without leaving the program; and, shopping within television programs through interfaces with MSN Shopping™ via .NET Web Services™. With the present invention, a user can: watch a favourite television show; view a item **510** (e.g. a watch) worn by a favourite celebrity with great detail using detail-in-context lenses **410** and within the context of a television program **505**; and, gain instant access to electronic shopping applications via MSN Shopping™ and .NET Web Services™ using a lens interface **503** and stored "Passport" profiles. For example, a user may use a remote control or tablet control **310** to activate **502** a detail-in-context lens presentation **505**, clearly view an item of interest **510**, and purchase the item **510** via an MSN Shopping™ interface **503**, all without leaving the context of the television program or its celebrities.

**[0090]** As mentioned above, a user typically interacts with a GUI by using a pointing device (e.g., a mouse) **310** to position a pointer or cursor **401** over an object and "clicking" on the object. Thus, an electronic shopping operation may be initiated by selection from a toolbar **501** or by selecting an object **510** within the original image. The pointing device (e.g. mouse) **310** is used to select an object **510** (e.g., icons, graphical objects, etc.) under a cursor **401**. Selecting may be initiated by holding down a button associated with the pointing device (e.g., a mouse button) **310** and gesturing with the pointing device **310** to indicate the bounds of the object **510** to be selected (as in a area or region selection), or simply by "clicking" on the object **510** under the cursor **401** (as in graphical object or icon selection). Selection may be indicated by a change in the visual display of the selected object **510** (e.g., by using reverse video, displaying a frame around the object, displaying selection handles around the object, etc.).

[0091] Once an object 510 is selected, a lens 410 is attached to the object 510. Any point on the selected object 510 may be chosen to be in the centre of the lens focus 420. In FIG. 5, the centre of the focus 420 of the lens 410 is attached to the approximate centre of the watch 510. The lens 410 may be configured using its associated GUI 400 in the manner described above. That is, the shape, size, magnification, scoop, and fold for the lens 410 may all be carefully tuned for the selected object 510. The lens 410 may be configured before attachment to the selected object 510 or after attachment. In addition, the lens 410 may be displayed before the object 510 is selected to aid in the selection of the object 510.

[0092] As the object 510 moves, the lens 410 moves with it. Alternatively, the lens 410 may be thought of as carrying the object 510, that is, the object 510 may be attached to the lens 410 such that as the lens 410 moves, the object 910 moves with it. Advantageously, since the magnification at the focus 420 of the lens 410 is greater than that at the base of the lens 410, the lens 410 may be used to select an object 510 in the presentation 505 with improved accuracy. In addition, the user is assisted throughout this selection operation by being able to observe the detail in the lens focus 420 in the context of the surrounding presentation 505.

[0093] In operation, the data processing system 300 employs EPS techniques with an input device 310 and GUI 400 for selecting an object 510 for display to a user on a display screen 340 and for which an electronic shopping operation will be performed. Data representing an original image (not shown) or representation is received by the CPU 320 of the data processing system 300. Using EPS techniques, the CPU 320 processes the data in accordance with instructions received from the user via an input device 310 and GUI 400 to produce a detail-in-context presentation 505. The presentation 505 is presented to the user on a display screen 340. It will be understood that the CPU 320 may apply a transformation to the shoulder region 430 surrounding the region-of-interest 420 to affect blending or folding in accordance with EPS technology. For example, the transformation may map the region-of-interest 420 and/or shoulder region 430 to a predefined lens surface, defined by a transformation or distortion function and having a variety of shapes, using EPS techniques. Or, the lens 410 may be simply coextensive with the region-of-interest 420. (Blending and folding of lenses in detail-in-context presentations are described in United States Patent Application Publication No. 2002/0044154 which is incorporated herein by reference.)

[0094] The lens control elements of the GUI 400 are adjusted by the user via an input device 310 to control the characteristics of the lens 410 in the detail-in-context presentation 505. Using an input device 310 such as a mouse, a user adjusts parameters of the lens 410 using icons and scroll bars of the GUI 400 that are displayed over the lens on the display screen 340. The user  
5 may also adjust parameters of the image of the full scene 505 using selections from the toolbar icon 501. Signals representing input device 310 movements and selections are transmitted to the CPU 320 of the data processing system 300 where they are translated into instructions for lens and image control.

[0095] Advantageously, by using a detail-in-context lens 410 to select an object 510 for an  
10 electronic shopping operation, a user can view a large area 505 (i.e. outside the lens 410) while focusing in on a smaller area 420 (i.e. inside the focal region 420 of the lens 410) surrounding the selected object 510. This makes it possible for a user to perform an electronic shopping operation without losing visibility or context of the portion of the original image surrounding the selected object 510. The selected object 510 may be viewed by the user as it is actually used by a  
15 character in the presentation 505. In this way, the "context" of the selected object 510 is also enhanced for the user. For example, the watch 510 is observed on a character's wrist while the character is in action rather than in a static "display case" like presentation.

[0096] Moreover, the lens 410 may be added to the presentation 505 before or after the object 510 is selected. That is, the user may first add a lens 410 to a presentation 505 or the user may  
20 move a pre-existing lens into place at, say, a selected point on an object 510. The lens 410 may be introduced to the original image (not shown) to form the presentation 505 through the use of a pull-down menu selection, tool bar icon 502, etc. The electronic shopping operation may then be activated using a toolbar selection or with a double click on the selected object 510. Now, as the selected object 510 moves to new locations within the presentation 505, the lens 410 is presented  
25 over and moves with the object 510.

[0097] *Video Game Control with Detail-In-Context Lenses.* According to another embodiment of the present invention, detail-in-context lenses and PDT are applied in gaming consoles such as Microsoft's Xbox™. These gaming consoles are often positioned as general-purpose entertainment devices and can benefit from the application of PDT. FIG. 6 is a screen capture

illustrating the application of detail-in-context lenses 410 in multi-player video games in accordance with an embodiment of the invention. In FIG. 6, lenses 410 are applied to game characters 610 to produce a detail-in-context video game presentation 605.

[0098] For example, with respect to the movement of gaming consoles towards a more general-purpose home entertainment platform, PDT provides the following functionality gains: enables more powerful online collaboration and multiplayer gaming capabilities; digital image editing and management; interactive television/web browsing; interactive advertising; and, it can function as a narrative/presentation tool or scripted communication tool. In addition, with respect to information storage, cataloging, and data management in Xbox™, PDT provides the following functionality gains: digital image management; viewing of different content layers and overlays brought into the lens at various scales; and, more efficient navigation of "cluttered" information, cataloging of song titles, movie titles, etc. With respect to image manipulation and presentation tools in Xbox™, PDT provides the following functionality gains: a powerful presentation tool that highlights area of interest; editing of images and models; and, 2D and 3D narration or scripting. With respect to the product developer, testing, animation, designer, and authoring tools in Xbox™, PDT provides: efficient detail-in-context viewing and in-place editing workspace for people that are spatially restricted within their on-screen 2D and 3D workspaces; and, a presentation/communication tool to help create, modify, test, and inspect graphics for quality control purposes. With respect to video games in Xbox™ (e.g. Strategy Puzzle, First Person Shooter, Role Playing, Flight Simulator, Action/Adventure, etc.), PDT provides: use of PDT for "cool" visual effects; increasing functionality of editing packages and tools used to create new worlds; adding to existing zooming and panning capabilities within games; and, an new mode of co-located multiplayer and online multiplayer interactivity. And, with respect to multi-player collaboration in Xbox™, PDT provides: a new mode of co-located multiplayer and online multiplayer interactivity; "cool" new special effects that are ideal for enhancement of narrative capabilities, increasing the draw-in rate of first person shooter games by allowing players to "see" further in front of a view, and detail-in-context viewing for role playing games where players are required to be aware of their surroundings at all times; increased functionality of editing packages and tools available to create and explore new worlds; additions to existing zooming and panning capabilities; and, as games migrate to handsets and PDA's, aid in the change of content and display of games.



[0099] In addition, using the lens interface, not only can a video game character 610 be viewed in greater detail but, detailed information 503 pertaining to the character 610 can be viewed. This detailed information 503 may be presented in a pop-up window and may include information such as available powers, weapons, reserves, points, skills, controls, etc., for the character 610.

5 Similar to the interface described above for linking to an external electronic shopping application, the detailed information 503 may include control icons and may provide an interface to an external gaming application available through a network such as the Internet.

[00100] *Advertising with Detail-In-Context Lenses.* According to another embodiment of the present invention, detail-in-context lenses and PDT are applied to advertising within digital media presentations. Detail-in-context lenses can be applied not only to television programs but  
10 also to other digital media presentations such as DVDs and video games. FIG. 7 is a screen capture illustrating a lens 410 applied to an advertisement 710 (e.g. a Yahoo™ banner) in a video game in accordance with an embodiment of the invention. In FIG. 7, the advertisement 710 is a Yahoo™ banner positioned along the sidelines of a soccer field in a soccer video game. The lens  
15 410 is applied to an advertisement 710 to produce a detail-in-context advertising presentation 705. The lens 410 can move with the action in the video game such that paid sponsors can have their banners 710, which are positioned in the background of the game presentation, highlighted and thus given attention as the game progresses. In other words, the lens 410 serves as a highlighting medium or spotlight to draw the user's attention to the advertised item 710. This  
20 improves user interaction with the advertisement as will be described below.

[00101] With respect to advertising in Xbox™, for example, a scripted lens 410 can move with the action to highlight advertising banners 710 for paid sponsors. As the game player progresses towards the goal, sequential banners 710 (e.g. Yahoo™, Toshiba™, etc.) are magnified or highlighted by the lens 410. In this way, the advertisements 710 follow the game  
25 play. Alternatively, a selected banner 710 may be stretched or deformed in the direction of play by the lens.

[00102] In addition, using the lens interface, not only can the advertisement 710 be viewed in greater detail but, detailed information 503 pertaining to the advertisement 710 can be viewed. This detailed information 503 may be presented in a pop-up window and may include

information such as the brand, model, and price of the advertised item **710**. As described above, the detailed information **503** may provide an interface to an external electronic shopping application.

**[00103]**      *Application Control with Detail-In-Context Lenses.* As mentioned, one shortcoming of present graphical user interfaces for operating systems and software applications is that user interface elements such as pop-up and drop-down menus comprising lists of programs (i.e. in the case of operating systems) and function selections (i.e. in the case of software applications) often obscure or occlude other important information on the user's display screen including data, desktop icons, and other graphical elements. Consider FIGS. 8 and 9. FIG. 8 is a screen capture illustrating a known operating system GUI **800** having various desktop icons **801**. FIG. 9 is a screen capture illustrating the operating system GUI **800** of FIG. 8 with an overlaid pop-up menu **901**. The appearance of the pop-up menu **901** (e.g. a "start menu") in FIG. 9 has occluded the visibility of several of the desktop icons **801** shown in FIG. 8. The pop-up menu **901** may appear upon user selection of one of the desktop icons **801**, for example.

**[00104]**      As described by Carpendale and referring again to FIG. 2, EPS technology includes a technique referred to as "folding" in which an in-context detail view of information can be displaced so as to move the region-of-interest **233** within the plane **201** of the display while maintaining a continuous connection with at least some of the contextual information **210**. In other words, the region-of-interest is folded over a portion of the visual information comprising the area surrounding the region-of-interest. According to one embodiment of the present invention, a novel form of folding is applied to an operating system GUI **800** to create an operating system GUI presentation in which occluded user interface elements (e.g. pop-up windows) **901** are distorted to expose underlying information or graphical elements (e.g. desktop icons) **801**.

**[00105]**      FIG. 10 is a screen capture illustrating an operating system GUI presentation **1000** in which detail-in-context folding is applied in accordance with an embodiment of the invention. In FIG. 10, the operating system is Microsoft XP™. A copy of the initial desktop **800** as illustrated in FIG. 8, prior to invoking the pop-up menu **901** illustrated in FIG. 9, is retained to facilitate display of the original icons **801** in the resultant folded GUI presentation **1000**. The

operating system GUI presentation **1000** is created by applying a detail-in-context lens to the pop-up menu **901** and then overlaying the resultant distorted pop-up menu **1010** on the original desktop **800**. In this way, predetermined ones of the original desktop icons **801** remain visible. In FIG. 10, the lens applied to the pop-up menu **901** has a flat, rectangular shaped top or focal region **1020** and two scooped sides or shoulders **1030** which terminate at the base **1012** of the lens. The focal region **1020** is folded away from the original desktop icons **801**, relative to the lens base **1012**, toward the right-hand side of the desktop **800**. The extent of the focal region **1020** and the degree of scooping **1030** may be selected automatically by the system **300** or the may be customized through use of a GUI **400** such as that illustrated in FIG. 4 and described above. Similarly, detail-in-context folding can also be applied to a pull-down (or drop-down) menu in a GUI for an application to prevent or remove occlusion of program related data. By folding menus in this way, a current menu **901** may be viewed in the context of underlying icons or menus **801**.

**[00106]**        *Method.* With respect to electronic shopping with detail-in-context lenses, FIG. 11 is a flow chart **1100** illustrating a method for initiating an electronic shopping transaction for a user-selectable item **510** presented in a computer generated original image on a display **340** in accordance with an embodiment of the invention.

**[00107]**        At step **1101**, the method starts.

**[00108]**        At step **1102**, a selection signal is received for the item **510** from a user. The selection signal may be generated by moving a cursor **401** on the display **340** with a pointing device **310**, such as a mouse, and clicking on the item **510**.

**[00109]**        At step **1103**, the original image is distorted to produce a distorted region **410** for the item **510** to provide the user with detailed information **503** for the item **510**. This step of distorting may further includes the steps of: creating a lens surface for the distorted region **410**; and, transforming the original image by applying a distortion function defining the lens surface to the original image. The step of creating may further include the step of displaying a GUI **400** over the distorted region **410** for adjusting the lens surface. The original image may be a DVD image, a video cassette image, a cable television image, a satellite television image, or a video game image. The distorted region **410** may be on the item **510** or may overlap the item **510**. The

detailed information may be the distorted region **410** itself or it may be purchasing information **503** for the item **510**. This purchasing information **503** may include a price, a product identifier, a delivery period, and function selection icons for the item **510**. The function selection icons may include a purchase icon and an add-to-shopping-cart icon. The purchasing information **503** may be presented in a pop-up window which may be presented adjacent to the distorted region **410** as illustrated in FIG. 5.

**[00110]** At step **1104**, a purchase signal is received for the item **510** from the user. The purchase signal may be generated by moving a cursor **401** on the display **340** with a pointing device **310**, such as a mouse, and clicking on a purchase or add-to-shopping cart icon. In this way, the electronic shopping transaction is initiated.

**[00111]** At step **1105**, the method ends.

**[00112]** Now, with respect to application control with detail-in-context lenses, FIG. 12 is a flow chart **1200** illustrating a method for presenting a second GUI **901** over a first GUI **800** on a computer display **340** to avoid occlusion of predetermined elements **801** of the first GUI **800** in accordance with an embodiment of the invention.

**[00113]** At step **1201**, the method starts.

**[00114]** At step **1202**, a determination is made whether overlaying the second GUI **901** on the first GUI **800** will occlude the predetermined elements **801**. This may be accomplished, for example, by comparing the x, y coordinates of the predetermined elements **801** and the second GUI **901**.

**[00115]** At step **1203**, in response to step **1202**, if the second GUI **901** will occlude the predetermined elements **801**, then the second GUI **901** is distorted to produce a distorted GUI **1010** having a distorted region **1020**, **1030** avoiding the occlusion of the predetermined elements **801**. This step of distorting may further include the steps of: creating a lens surface for the distorted region **1010**; and, transforming the second GUI **901** by applying a distortion function defining the lens surface to the second GUI **901**. The lens surface may be a folded lens surface. The folded lens surface may include a focal region **1020** and a base region **1012** where the focal

region **1020** is folded away from the predetermined elements **801** relative to the base region **1012**. The step of creating may further include the step of displaying a GUI **400** over the distorted region **1010** for adjusting the lens surface. The first GUI may be a desktop GUI **800** and the predetermined elements may be predetermined icons **801** in this desktop GUI **800**.

- 5 Alternatively, the first GUI may be a menu including a pop-up menu and a pull-down menu. In this case, the predetermined elements may be predetermined items in the menu. The second GUI may also be a menu **901** including a pop-up menu and a pull-down menu.

**[00116]** At step **1204**, the distorted GUI is overlaid on the first GUI for presentation on the display **340**.

- 10 **[00117]** At step **1205**, the method ends.

**[00118]** *Data Carrier Product.* The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processing system of FIG. 3 can be contained in a data carrier product according to one embodiment of the invention. This data carrier product can be loaded into and run by the exemplary data processing system of FIG.

- 15 3.

**[00119]** *Computer Software Product.* The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processing system of FIG. 3 can be contained in a computer software product according to one embodiment of the invention. This computer software product can be loaded into and run by the exemplary data processing system of FIG. 3.

- 20

**[00120]** *Integrated Circuit Product.* The sequences of instructions which when executed cause the method described herein to be performed by the exemplary data processing system of FIG. 3 can be contained in an integrated circuit product including a coprocessor or memory according to one embodiment of the invention. This integrated circuit product can be installed in

- 25

**[00121]** Although preferred embodiments of the invention have been described herein, it will be understood by those skilled in the art that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.